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Investigating The Local Food System: A Mixed Methods Study Of Sustainability in Southwest Atlanta

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INVESTIGATING THE LOCAL FOOD SYSTEM: A MIXED METHODS STUDY OF SUSTAINABILITY IN SOUTHWEST ATLANTA

by

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Under the Direction of Dr. Timothy Hawthorne

ABSTRACT

Local food systems can play an important role in the environmental sustainability and human health of communities. This study aims to evaluate connections between the local food system and the retail environment in Southwest Atlanta, Georgia (USA) through mixed methods research. Agriculture site interviews and field research evaluate issues surrounding the local food system from a qualitative perspective. A mobile Geographic Information Systems (GIS) framework is developed to evaluate access and disparities in the retail food landscape from a quantitative perspective. This framework can be leveraged by residents and community stakeholders towards strategic primary data and research needs. In using both qualitative and quantitative methods, a more comprehensive study of the local food system and overall sustainability of communities is enabled. The results of this study may better inform planning and policy decisions and serve as a research model for use in other geographies.

INDEX WORDS: Atlanta, Urban geography, Sustainable urban agriculture, Geographic information systems, Local food system

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DEDICATION

This thesis is dedicated to my wife, Jean Hee Barrett, for her loving support; I am eternally grateful.

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1 INTRODUCTION

Local food systems can play an important role in the overall sustainability and human health of communities. Using mixed methods research, this study aims to evaluate connections between the local food system and the retail environment in Southwest Atlanta, Georgia. For the purpose of this thesis, mixed methods research refers to the application of both qualitative and quantitative methods.

Sustainable agriculture can be a component to local food systems where food is produced and consumed within a local context. Local sustainable food systems reduce food miles, regenerate and restore ecosystem balance, promote healthy alternatives to processed food, and strengthen local communities (Metcalf and Widener 2011; Jarosz 2008; Marcia 2008; Feagan 2007; Hansen 1995). The local food movement is supported through increasing numbers of urban agriculture sites, farmers markets, community gardens, community supported agriculture (CSA) initiatives, farm to school programs, and rooftop gardens. Such initiatives suggest a growing awareness of the environmental, social, and health benefits of local food systems (Macias 2008).

Much of the existing research on food systems utilizes conceptual frameworks that view sustainability as a closed loop system and attempt to establish criteria for evaluation of these systems (Hill and MacRae 1998; Hawkin et al. 1999; Rigby et al. 2001; Metcalf and Widener 2011). Availability of food across space represented by food sheds, disparities in food represented by food deserts, and related access issues have been studied in many communities (Block et al. 2004; Webber and Dollahite 2008; Eckert and Shetty 2011; Czarnezskie 2011). Ad-

ditionally, varied perceptions, competing values, and conflicting interests have been studied in regards to food systems (Knigge and Cope 2009). In contrast to sustainable agriculture, the conventional food system is defined by agricultural industrialization at a scale, practice, and intensity that cannot be sustained (Sahu 2011). Natural resources that the food system is dependent upon are degraded and vast food miles exist between production and consumption (Czarnezski 2011).

In using mixed methods research, this study aims to evaluate the local Southwest Atlanta food system known as the Fertile Crescent. By utilizing a mobile Geographic Information Systems (GIS) framework, fresh produce is evaluated in the retail environment to examine access disparities and investigate possible relationships to sustainability from a quantitative perspective. Field research and interviews are leveraged to evaluate access and disparities from a qualitative perspective. This mixed methods approach enables a more comprehensive study of local connections between the production and retail environment of the Fertile Crescent food system. In addition, by incorporating both qualitative and quantitative methods, a deeper understanding to local context, issues, barriers and opportunities relating to the local food system may be gained.

1.1 Literature Review

The conventional food system is defined by agricultural industrialization on a global scale where high yields are produced though at a scale, practice, and intensity that can't be sustained (Sahu, 2011) while promoting a disconnect between people and local fresh food (Turner et al. 2011). Natural resource degradation is inherent in industrial agriculture, which is prob-

lematic since the food system is dependent upon these natural resources to thrive (Sahu 2011). Conventionally grown crops are typically of a single variety, involve intense application of inorganic chemical fertilizers and pesticides, utilize fossil fuel-based mechanization, and exhibit vast food miles traveled between source and consumption (Czarnezski 2011). Specific environmental degradation of the ecosystem includes deforestation, negative impacts to soil, surface and ground water, and biodiversity loss (Kremer 2011). In addition, industrial agriculture has led to weaker relationships between people -primarily in the urban environment - and the food system (Turner et al. 2011). Therefore, the conventional food system is ecologically unbalanced, characterized by degradation to underlying natural resources, and weakening relationships between people and local food.

Given the limitations of the conventional food system, local food movements are developing that focus on sustainable food. Sustainable food is defined by Sustain: The Alliance for Better Food and Farming (2002, p.2) as food that includes the following criteria:

- Proximate – originating from the closest practicable source or the minimization of energy use
- Healthy as part of a balanced diet and not containing harmful biological or chemical contaminants
- Fairly or cooperatively traded between producers, processors, retailers, and consumers; non-exploiting of employees in the food sector in terms of pay and conditions; environmentally beneficial or benign in its production (e.g. organic)
- Accessible both in terms of geographic access and affordability
- High animal welfare standards in both production and transport
- Socially inclusive of all people in society; and encouraging knowledge and understanding of food and food culture.

Conventional and sustainable agriculture are compared in Table 1 below (Hill and MacRae 1998).

Table 1.1 Comparison of Conventional and Sustainable Agriculture (Hill and MacRae 1998)

Conventional	*Sustainable*
Symptoms	Causes, prevention
Reductionist	Holistic
Eliminate 'enemies'	Respond to indicators
Narrow focus (neglects side-effects; health and environmental costs ignored)	Broad focus (sub-cellular to all life to globe all costs internalized)
Instant	Long time frame (future generations)
Single, simple (magic bullet, single discipline)	Multifaceted, complex (multi- and trans-disciplinary)
Temporary solutions	Permanent solutions
Unexpected disbenefits (to person and planet)	Unexpected benefits
High power (risk of overkill and errors/ accidents)	Low power (minimal risk)
Direct 'attack'	Indirect, benign approaches (catalytic, multiplier, synergistic effects)
Imported	Local solutions and materials
Products	Processes, services
Physico-chemical (often unnatural, synthetic)	Bio-ecological (natural)
Technology-intensive	Knowledge/skill intensive
Centralized	Decentralized (human scale)
Values secondary	Compatible with higher values
Expert, paternalistic (arrogant)	Individual/community responsibility (humble)
Dependent	Self-maintaining/regulating
Inflexible Ignores freedom of choice (unjust)	Flexible Respects freedom of choice (just)
Disempowering	Empowering
Competitive	Co-operative
Authored	Anonymous (seeking neither reward nor fame)

A closed loop systems framework of sustainable agriculture can serve to regenerate rather than deplete natural resources (Metcalf and Widener 2011). Metcalf and Widener contend that in consideration that "humans are part of the earth's ecosystem, and the economy is of our own devise, a hierarchical conception of the three pillars of sustainability (ecology > society > economy) is warranted" (2011, p. 1242). With this perspective, closed loop sustainable

ecosystems management can be developed. Four basic shifts relating to material flows that serve as a theoretical foundation to sustainable food systems were developed by Hawkin et al. (1999). The first attribute is Radical Resource Productivity with a focus on efficiency and innovative application of technology. The second is biomimicry that utilizes "biologically inspired models of closed loop production systems" (Metcalf and Widener 2011, P. 1247). The third involves a shift from product to service, where responsibility is realigned to the producer rather than consumer. Metcalf & Widener (2011) elaborate, "in a service-based model, the producer (in this case, the farmer) maintains ownership of goods produced, encouraging "take back" activities such as remanufacturing, recycling and/or composting when the product's useful life ends" (p. 1247). The authors note that CSAs often operate in this way, offering a box or basket as a recurring service. The last attribute is the investment in natural capital where humans at "both the individual and institutional level must restore, sustain, and expand the planet's ecosystems to recreate an abundance of resources and services" (Metcalf and Widener 2011, p. 1247).

Local food systems are also referred to as Alternate Food Networks (AFNs) (Jarosz 2008). Jarosz describes aspects of AFNs such as proximity between producers and consumers, small-scale operations, direct local food retail vendors such as farmers markets and food cooperatives, and environmentally sustainable farming practices. AFNs "emerge from political, cultural, and historical processes" that "develop out of the interactions between rural restructuring and urbanization in metropolitan areas" (Jarosz 2008, p. 242).

One metric developed to evaluate sustainable agriculture is the Indicator of Sustainable Agriculture Practice (ISAP) (Rigby et al. 2001). This metric has four criteria of sustainability at

the farm level: minimizing off-farm inputs, minimizing non-renewable inputs, maximizing natural biological processes, and promoting local biodiversity.

Sustainable agriculture can be implemented through local farms, Community Supported Agriculture (CSA) programs, community gardens, rooftop gardens, farm to school programs, and farmers markets. CSAs are cooperative agreements directly between the farmer and the consumer, first adopted in Massachusetts in 1995 (Janssen 2010). Members pay at the beginning of the season for a share of the produce throughout the season. Community gardens can also contribute towards sustainability in local sustainable food systems. Holben discusses a program in Athens County, Ohio called The ECOhio Garden Project (2011). The program teaches sustainable gardening practices to improve access to fresh fruit and vegetables for the community. For example, gardening workshops and trainings were held with stakeholders in the community.

Farm to school programs in local government can provide educational opportunities to youth while contributing to the sustainability of local food systems and promoting healthy lifestyles. Phillips-Nania et al. (2011) discuss the growing interest in farm to school programs and associated variables contributing towards, and barriers to success. Barriers include varying support and priorities within school systems, the robustness of the local agricultural market, and funding mechanisms.

Much of the existing literature relating to the benefits of local food systems focus on production to mitigate low access and increase security in areas sometimes referred to as food deserts (Block et al. 2004; Webber and Dollahite 2008; Eckert and Shetty 2011; Czarnezskie 2011; Giang et al. 2008, Walker et al. 2010; Gordon et al. 2011; Corrigan 2011). Food deserts

are generally defined by geographies with low physical access to fresh foods, may relate to areas of high poverty and influence negative health outcomes (Drewnoski & Specter 2004; Coveney & O'Dwyer 2009). While many of the benefits beyond food production of sustainable agriculture are beginning to be recognized, more research into the value of these benefits is needed (Beilin & Hunter 2011; Macias 2008).

Though tools to evaluate connections of locally grown produce to the retail environment are missing in the literature, there are other relevant methods present. To evaluate overall availability – without regard to sourcing- and key variables of fresh produce in the retail environment, surveys such as the Nutrition Environment Measures Survey– Stores (NEMS-S) (Glanz et al. 2007) and NEMS – Corner Stores have been developed (Cavanaugh et al. 2013). However, these surveys are paper-based and may benefit from future technology applications such as GIS in data collection and analysis.

To summarize, the conventional food system is characterized by ecological unbalance and degradation to environmental support systems (Sahu 2011; Czarnezski 2011) and weakening connections between people and food (Turner et al. 2011). In response to growing awareness of these limitations, local food movements are developing that focus on sustainable food as an ecologically sound and healthier alternative to the conventional food system (Metcalf and Widener 2011; Macias 2008; Jarosz 2008; Marcia 2008; Feagan 2007; Hansen 1995). Much of the current research on food systems detail conceptual frameworks that view sustainability as an ecologically benign or restorative closed loop system and attempt to establish criteria for evaluation of these systems (Hill and MacRae 1998; Hawkin et al. 1999; Rigby et al. 2001; Metcalf and Widener 2011). Various implementations of local food systems include community

gardens, urban farms, CSAs, farm to school programs, and rooftop gardens. Sustainable local food production and healthy food access mitigate low access and increase security in food deserts, though other social benefits are beginning to be recognized (Beilin & Hunter 2011; Macias 2008). Though tools are not present in the literature to examine connections between the local food system and the retail environment, surveys exist to evaluate overall fresh produce and may be adapted for future research needs (Glanz et al. 2007; Cavanaugh et al. 2013).

Through mixed methods research, the objective of this study is to evaluate the connections between the local Southwest Atlanta Fertile Crescent food system and the retail environment from a qualitative and quantitative perspective. In the next section, the study area and research objectives are outlined in relation to the local Atlanta food system.

1.2 Study Area and Research Objectives

Given that readily available census or proprietary data are coarse in resolution, these data lack neighborhood scale, fine grained detail. To address these limitations, partnerships were formed to strategically develop primary data and research interests to better inform planning and policy analysis decisions regarding the local Atlanta food system. In collaboration with the Atlanta Metro Food and Farm Network and the City of Atlanta Sustainability Office, the study area of the Fertile Crescent in Southwest Atlanta is adopted, as shown in Figure 1.2.1. The Fertile Crescent is roughly 3.6 square miles and aligns generally with the Southwest Atlanta BeltLine corridor. This area exhibits a high density of urban agriculture sites making it ideal to conduct interviews for the qualitative methods in the study.

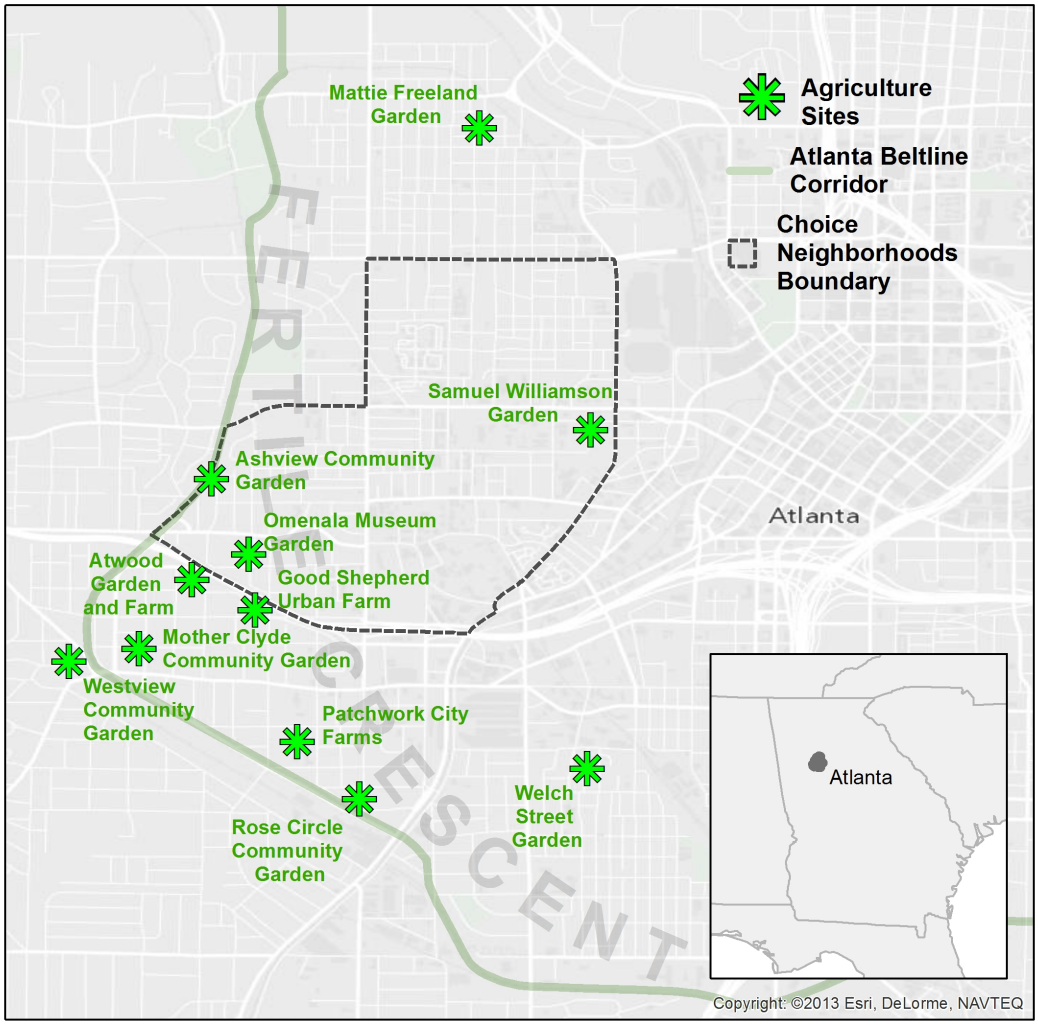

Figure 1.2.1 Map of Study Area. Map by Ryan Barrett.

In addition, the smaller area of 1.6 square miles known as Choice Neighborhoods is determined to represent the geography for the GIS-based shelf survey. The Choice Neighborhoods area is comprised of the Ashview Heights, Atlanta University Center, and Vine City neighborhoods. Both the broader Fertile Crescent and Choice Neighborhood geographies are currently being studied by the Atlanta Metro Food and Farm Network and other planning partners whereby a strategic partnership affords the opportunity to collaborate towards Atlanta food

system planning and research. The smaller geography of the refined study area affords an opportunity for primary data collection from a quantitative and qualitative perspective in order to gain further insight regarding the local food system. Additionally, the low density, sprawling land use development of the Atlanta area allows for increased land availability for sustainable urban agriculture compared to higher density metropolitan areas. Thus, the objective of this research is to evaluate the connections between the local Fertile Crescent food system and the retail environment using mixed methods research.

To summarize, as a result of strategic collaboration with community partners, the study area of the broader Fertile Crescent and Choice Neighborhoods geography is adopted. The anticipated results of the study are discussed in the next section.

1.3 Anticipated Results

It is the aim of this research to contribute towards the body of knowledge relating to a local food system by evaluating connections between local agriculture sites and the retail environment in Southwest Atlanta, Georgia (USA) through mixed methods research. The results may better inform planning and policy decisions regarding sustainable food. Additionally, primary field data analysis may contribute further towards the understanding of the local Atlanta food system. This research could also be applied to research regarding sustainable food in other geographies.

Most importantly, this mixed methods approach has the potential to reveal insights that would not be possible through the use of solely quantitative or solely qualitative methods. It also relies heavily on interactions with local community members that develop, work and bene-

fit from these local food systems. By talking directly with these food system users, the research can represent and analyze first-hand, local knowledge about local food movements. In this way, the study provides an opportunity for residents to tell the story of the local food system with the hope that others can learn from these stories and develop more sustainable local food system movements in Atlanta and beyond.

2 METHODS

It is the aim of these methods to evaluate connections between local food system production and the retail environment in the Fertile Crescent, Southwest Atlanta. Quantitative and qualitative research methods are employed for this study and detailed in two components. First, qualitative research methods in the form of interviews at local agriculture sites are outlined. Second, quantitative methods from the development and deployment of a mobile GIS-based shelf survey to evaluate the local availability of produce in the retail environment are discussed. In the below sections, the methods relating to the local agriculture site interviews in the broader Fertile Crescent and the GIS-based produce shelf survey in the Choice Neighborhoods are introduced.

2.1 Local Agriculture Site Interviews

The first research method entails qualitative research and analysis from interviews at local agriculture sites in the Fertile Crescent area to investigate the history, barriers, challenges and opportunities related to a sustainable local food system. Interview questions were developed and refined in collaboration with the Atlanta Metro Food and Farm Network for field data

collection. The interviews with local residents are an open-ended format to ensure an informative discussion. Interview questions are detailed in table 2.1.1 below.

Table 2.1.1 Agriculture Site Interview Questions

- When and how did the garden get started?
  - Was it designed as a grassroots initiative to meet needs or was it a result of gentrification?
- How is it funded and maintained?
  - Inside/outside the neighborhood?
  - Are there trust issues given the leadership and structure of the garden?
- What is the distribution of the food produced at the site?
- Are pesticides or herbicides applied?
- Are crops rotated?
- How are soil nutrients replenished?
- Who has access to the garden site? How does one gain access to the site?
- What are some of the benefits of the garden to the community?
- What are some of the barriers or challenges for the garden?
- Beyond volunteering, how can an individual contribute to the garden?

A total of twenty-five Atlanta agriculture site visits take place from April 2012 through April 2013. Eleven sites are unique, where ten interviews are given at seven sites. In the next section, the produce shelf survey component is introduced.

2.2 Produce Shelf Survey

The second component to the research methods involves quantitative analysis from the development and deployment of a mobile shelf survey to evaluate the local availability of produce in the retail environment of the Choice Neighborhoods area. The survey criteria were strategically developed in collaboration with the Atlanta Metro Food and Farm Network and

the City of Atlanta Office of Sustainability, adapted from the paper-based Nutrition Environment Measures Survey (Glanze et al. 2007, Cavanaugh et al. 2013). Through this collaborative mapping framework, planning and policy considerations may better facilitate connections between local private gardens, community gardens, and urban farms and retail opportunities. This effort may serve to stimulate local economic growth, strengthen sustainability and promote positive health outcomes in neighborhood communities. The research questions for the shelf survey are detailed in Table 2.2.1 and 2.2.2 below.

Table 2.2.1 Produce Shelf Survey Research Questions I

- Is local, sustainably grown produce available across the study area?
- Is produce advertised outside of the retail outlet? Women Infants and Children (WIC) program?
- What is the retail outlet type and number of registers?
- Is fresh produce available?
- How prominent is produce placement?
- What is the total vegetable, fruit, and herb variety?
- What is the ratio of local or organic?

In addition, finer grained research questions were developed for the top three vegetable and fruit by shelf area. Additional research questions are represented in Table 2.2.2 below.

Table 2.2.2 Produce Shelf Survey Research Questions II

- What is the specific variety?
- Is the quality acceptable or is freshness questionable?
- Is the produce locally sourced? If so, what is the source? If not, what is the source?
- Is the produce labeled organic?
- What is the price?

With survey criteria established, a data model for mobile field collection was developed. Data model development took place through the Environmental Systems Research Institute ArcGIS 10.1 platform, where the final model is illustrated in Appendix A. First, broader retail outlet attributes in the data model are outlined in Table 2.2.3. Table 2.2.4 details more specific attributes in the data model related to the top three fruit and vegetables in the retail environment by shelf area.

Table 2.2.3 Produce Shelf Survey via ArcGIS Mobile App, adapted from Glanz et al. (2007) and Cavanaugh et al. (2013)

FIELD ALIAS	ATTRIBUTE	DOMAIN	TYPE	LENGTH	GEODATABASE FIELD NAME
Created By	Automatically populated	NA	Text	20	CREATEDBY
Date Created	Automatically populated	NA	Date	10	DATECREATED
Last Edit By	Automatically populated	NA	Text	20	LASTEDITBY
Last Edit Date	Automatically populated	NA	Date	10	LASTEDITDATE
Store Name	[Text Input]	NA	Text	100	STORE_NAME
Store Type	Convenience Store	StoreType	Text	30	STORE_TYPE
	Gas Station				
	Other Grocery <2500sqft				
	Supermarket				
	Other - note in comments				
WIC Advertised	Yes	YesNo	Text	3	WIC_ADVERT_OUTSIDE

FIELD ALIAS	ATTRIBUTE	DOMAIN	TYPE	LENGTH	GEODATABASE FIELD NAME
Outside	No				
Fresh Produce Advertised Outside	Yes	YesNo	Text	3	FRESH_PROD_ADVERT_OUTSIDE
	No				
Number of Registers	[Number Input]	NA	Integer	Short	NUMBER_REGISTERS
Produce Availability	Yes	YesNo	Text	3	FRESH_PRODUCE
	No				
Produce Placement	Front	Placement	Text	6	PLACEMENT
	Middle				
	Back				
	Other - note in comments				
Vegetable Variety Total Number	[Number Input]	NA	Integer	Short	VEGETABLE_VARIETY
Fruit Variety Total Number	[Number Input]	NA	Integer	Short	FRUIT_VARIETY
Herb Variety Total Number	[Number Input]	NA	Integer	Short	HERB_VARIETY
Local Variety Total Number	[Number Input]	NA	Integer	Short	LOCAL_VARIETY
Organic Variety Total Number	[Number Input]	NA	Integer	Short	ORGANIC_VARIETY

Table 2.2.4 Produce Shelf Survey Top 1 Vegetable by Shelf Area

FIELD ALIAS	ATTRIBUTE	DOMAIN	TYPE	LENGTH	GEODATABASE FIELD NAME
Top 1 Vegetable	[Text Input]	NA	Text	50	TOP_1_VEG
Top 1 Veg Qty	1 to 5	Qty	Text	5	TOP_1_VEG_QTY
	6 to 9				
	10 +				
Top 1 Veg Quality acceptable	[Number Input]	NA	Integer	Short	TOP_1_VEG_ACCEPTABLE
Top 1 Veg Quality unacceptable	[Number Input]	NA	Integer	Short	TOP_1_VEG_UNACCEPTABLE
Top 1 Veg Organically Grown	Yes	YesNo	Text	3	TOP_1_VEG_NATURAL
	No				
Top 1 Veg Locally Sourced	Yes	YesNo	Text	3	TOP_1_VEG_LOCAL
	No				
Top 1 Veg Local Source	[Text Input]	NA	Text	50	TOP_1_VEG_LOCAL_SOURCE
Top 1 Veg Non-Local Source	[Text Input]	NA	Text	50	TOP_1_VEG_NONLOCAL_SOURCE
Top 1 Veg Price	[$/lb or qty input]	NA	Text	50	TOP_1_VEG_PRICE

The last component of the produce shelf survey data model entails the use of field attribute domains where possible to streamline mobile data collection. Domains include Store Type, Yes or No, Quantity range, and Placement, as shown in Table 2.2.5. By utilizing domains, direct drop down value selections are enabled, which serve as a significant streamlining and quality control measure, especially in the mobile data collection environment.

Table 2.2.5 Produce Shelf Survey Domains

Domain	Value	Domain	Value
StoreType	Convenience Store	**Qty**	1 to 5
	Gas Station		6 to 9
	Other Grocery <2500sqft		10 +
	Supermarket	**Placement**	Front
	Other - note in comments		Middle
YesNo	Yes		Back
	No		Other

With the data model established, a Spatial Database Engine (SDE) geodatabase point feature class was generated in ArcGIS 10.1 and appropriate fields, data types and domain values created and assigned. Next, an SDE feature class of city of Atlanta neighborhood polygon boundaries was used to create a new polygon of the Choice Neighborhoods study area.
The last data to prepare were ESRI Business points for field reference. North American Industry Classification System (NAICS) codes were used to query type of food outlet, and a spatial selection applied to a subset of city of Atlanta retail outlets. Supermarkets and other grocery stores less than 2500 square feet are combined in ESRI business data. To distinguish supermarkets, other grocery outlets less than 2500 square feet were queried into a discrete type and symbol-

ized separately. A total of 14 ESRI food retail outlets are identified for field reference.

Next, the SDE feature classes were added to an ArcMap document and symbolized appropriately. With the MXD prepared, a shared service was created in ArcGIS Server. Default settings were accepted with two exceptions: feature access was enabled to allow editing and service timeout was expanded from 600 to 36000 seconds to allow for adequate field collection without service interruption.

Field collection took place from January through March 2013 using the ArcGIS mobile platform deployed on Apple iPad and iPhone devices. The ArcGIS mobile field collection interface is shown in Figure 2.3.1. The Apple iPhone and Motion X GPS tracking application was utilized to effectively monitor routes traveled to ensure complete coverage of approximately 1.6 square miles of the Choice Neighborhoods area, as illustrated in figure 2.3.2.

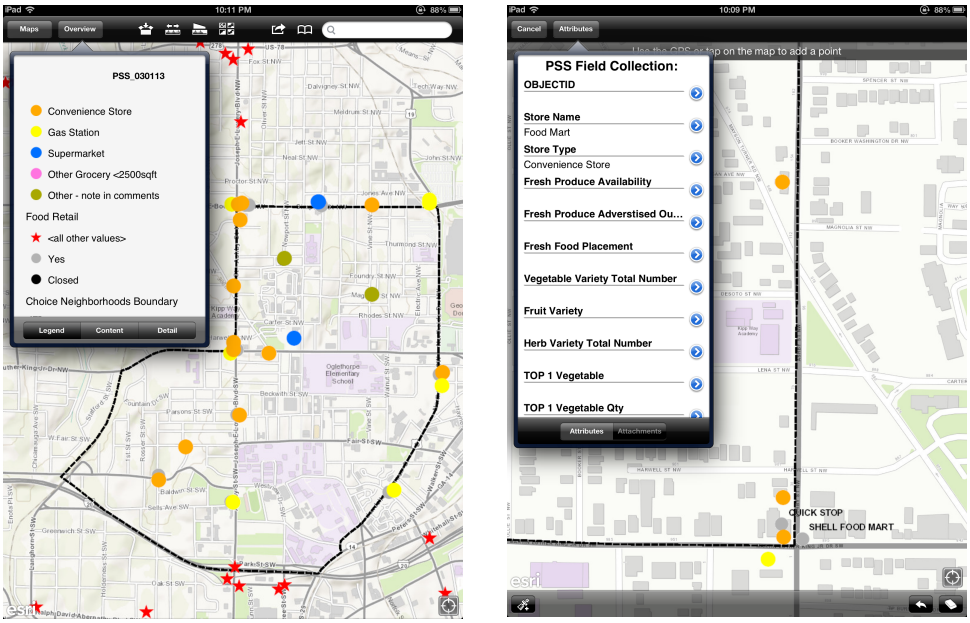

Figure 2.3.1 ArcGIS Mobile Field Collection Interface

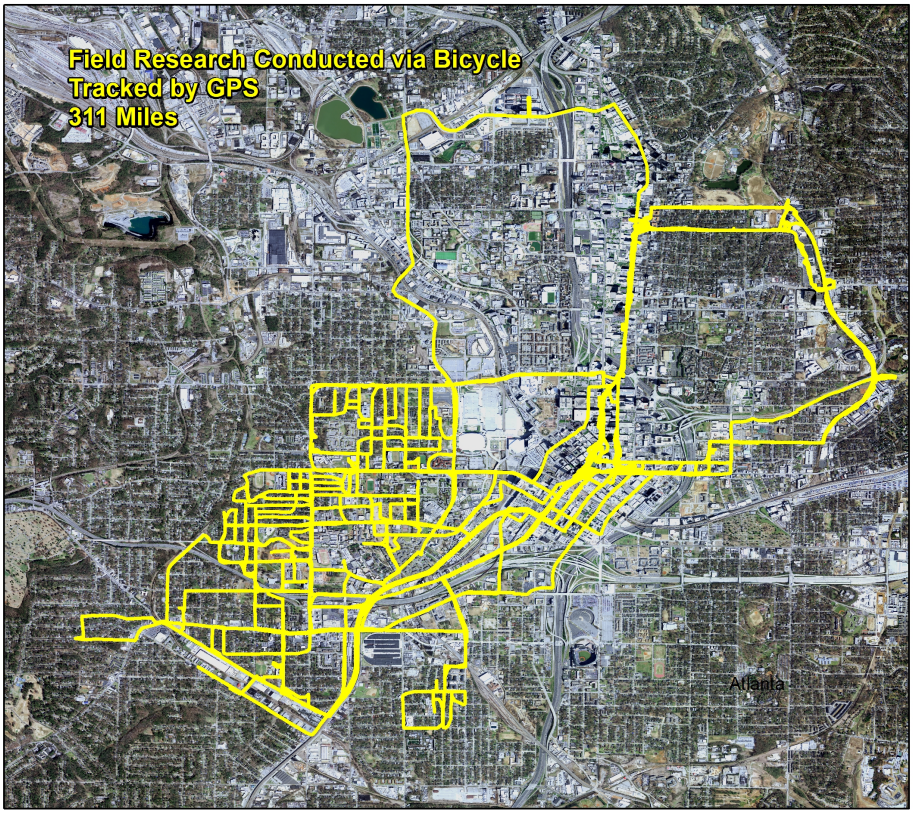

Figure 2.3.2 Field Survey GPS Routes

To summarize, by collaborating with community partners, the traditional paper based food survey is expanded and a GIS-based framework is developed to evaluate connections in the retail environment to the local food system. With qualitative and quantitative research methods outlined above, the results and discussion are outlined in the next section.

3 RESULTS AND DISCUSSION

Results from the primary field data collection are outlined below. First, agriculture site visits are reviewed where interviews sought to gain insight into the history, operations, barriers and challenges of the local food system. Next, the second research component to evaluate lo-

cal connections and overall fresh produce availability is discussed. Lastly, the discussion of these results is outlined.

3.1 Agriculture Site Visit Interview Results

The first component to the results entail qualitative research and analysis from interviews at local agriculture sites in the Fertile Crescent area to investigate the history, operations, barriers, challenges and opportunities related to sustainable local food system. Interview questions were developed and refined in collaboration with the Atlanta Metro Food and Farm Network for field data collection. The interviews with local residents are an open-ended format to ensure an informative discussion. To review, interview questions are detailed in table 3.1.1 below.

Table 3.1.1 Agriculture Site Visit Interview Questions

- When and how did the garden get started?
  - Was it designed as a grassroots initiative to meet needs or was it a result of gentrification?
- How is it funded and maintained?
  - Inside/outside the neighborhood?
  - Are there trust issues given the leadership and structure of the garden?
- What is the distribution of the food produced at the site?
- Are pesticides or herbicides applied?
- Are crops rotated?
- How are soil nutrients replenished?
- Who has access to the garden site? How does one gain access to the site?
- What are some of the benefits of the garden to the community?
- What are some of the barriers or challenges for the garden?
- Beyond volunteering, how can an individual contribute to the garden?

The origin, funding and maintenance of the urban agriculture sites are detailed in ***Appendix Table B.1***. The sites are all established within the last five years with the impetus being grassroots initiatives in all but one site, in which case both internal and external neighborhood influences were present. Sites exhibit a heavy reliance on volunteer labor for maintenance, with various funding mechanisms ranging from personal financing and sweat equity to grants and corporate donations.

Appendix Table B.2 describes operational environmental factors of seed sourcing and soil nutrient replenishment. Sustainable production practices are widely recognized and implemented across the urban agriculture sites. Pest, weed, and disease control along with crop management, and land area is outlined in ***Appendix Table B.3***. Sites range in size from less than a quarter of an acre to 5 acres. No sites utilize chemical herbicides or pesticides, and all but one site practice crop rotation, intercropping, or companion planting.

Appendix Table B.4 describes the sales method, distribution channel of food and access across the agriculture sites. Four of the seven sites bring produce to market. One site has approached retail food outlets in the neighborhood to stock local produce though store owners have not expressed interest. The distribution of food from the agriculture sites varies across geographies, both inside and outside of the neighborhood. In discussion of barriers and challenges, insights towards the distribution of food outside the neighborhood are detailed below.

There are many ways an individual can contribute to an urban agriculture site beyond volunteering, as listed in ***Appendix Table B.5***. These include contributing financial and material resources as well as taking action to raise awareness or educate others about urban agriculture.

A total of 67 vegetable, fruit and herb varieties are grown across the local agriculture sites, as shown in ***Appendix Table B.6***. The highest ranking produce item is tomatoes, grown at five of the seven sites. Squash, onions, eggplant, and cucumbers are tied as the second highest ranked produce items grown at three of the seven sites. The third highest ranked produce items grown across two agriculture sites include arugula, collards, carrots, green beans, herbs, kale, leeks, mustard greens, okra, peppers and strawberries.

Many interrelated benefits are recognized when interviewees are asked about benefits of urban agriculture sites to the community. Of the 85 total benefits of urban agriculture to the community, food production and access accounted for 13% of benefits, where other benefits accounted for 87% as shown in table 3.1.2.

Table 3.1.2 Interview Response Benefits to Urban Agriculture

Benefit	Number	Percent
Healthy food production/access	11	13
Other benefits	74	87

Further refinement in the classification of responses reveals that food production and access interrelates to many contributing variables of urban agriculture towards the overall environmental, social, and economic sustainability in a community, as shown in table 3.1.3. The highest ranking benefit to urban agriculture from interview responses is social, at 41%. The next highest ranked benefit is environmental and social at 15%. Educational and environmental is the third highest ranked benefit at 13%.

Table 3.1.3 Benefits of Urban Agriculture

Benefit	Number	Percent
Social	35	41
Environmental/ Social	13	15
Educational/ Environmental	11	13
Environmental	6	7
Environmental / Health	5	6
Environmental/ Health/ Social	3	3
Health	3	3
Health/ Social	3	3
Economic	2	2
Educational	2	2
Educational/ Environmental/ Health	2	2
Economic/ Social	1	1

A prominently recognized benefit to local urban agriculture is healthy food production to increase food access and security. However, as the responses show, there are many other interrelated benefits to the community. For example, beyond food production, urban agriculture sites serve a significant community asset. A gardener at the Mattie Freeland Garden states:

> The garden provides greater access to healthy food and that's important but this garden was started to provide community space for neighbors to connect, somewhere to have picnics and BBQs and other neighborhood events giving an area for neighbors to come outside to talk with one another, and a place for children to play out of street". Furthermore, (The garden) is also place of beauty. There are a lot of images of despair and abandonment in our neighborhood. There are a lot of vacant and dilapidated houses, and this provides a space where things are living and can thrive; a subtle sign of hope and investment.

Moreover, a gardener at the Ashview Community Garden notes:

> The benefits are to learn about agriculture, to learn about the natural food system that we previously have little information about; to make more tangible and engaging, to have a place to go anytime to be involved with something that connects the community socially and brings kids together. A place to have community functions; it's more than a garden. It's an outside venue, a place to socialize and a meeting ground for children and elders, it builds connectedness in community, creating a garden and community space.

> The garden is a social and spiritual building place to uplift people mentally and health wise.

Additionally, a gardener at the Rosewood Circle garden states:

> The garden has huge benefits. This used to be field of kudzu, now it is attractive food production. There is aesthetic value and it is a healthy food option, a place for kids to participate and experience healthy physical labor. The garden is positive spiritually and emotionally, it is good to be surrounded by nature. It helps in building community relationships- it's good to be around kids, for fellowship. The garden is a great asset and builds interest from neighboring community members where people can experience new things and learn to grow and build a sense of community and accomplishment. It also adds monetary value and helps with safety. Neighbors look out for one another and the garden and take ownership. It brings attention to gardening and our neighborhood. It brings people together.

Furthermore, the urban agriculture sites serve as an educational and training opportunity, though sites are constrained by financial and material resources to have a greater influence to the community; therefore this is also a challenge and barrier. A farmer at the Patchwork City Farms states, "We could do a lot more with investors and move beyond production to cooking sessions and education programing to providing education for young people and providing jobs in underserved communities".

The survey responses also reveal many other challenges and barriers to urban agriculture across the study sites. Specifically, survey responses reveal many resource constraints to the local food system, a lack of community buy in and awareness, as well as socio economic, cultural and racial barriers.

Resource constraints include land ownership, capital, material, water, and transportation. A farmer at Patchwork City Farms states, "Land that we don't have to lease but own would make the farm more permanent". Park or public space is perceived as being deficient in the community where urban agriculture helps to mitigate. A gardener at Mattie Freeland com-

ments, “We don’t even have a park, a clinic, recreation space, and no substantial public infrastructure. Greenspace is a very importation issue, to have a place for kids to play and neighbors to connect. We have smaller lots and kids need a space to play and for community to gather. We need more internal spaces for neighborhoods which is vital for community health”. In addition, many farmers expressed concern with the absence of a legalizing land use classification for urban agriculture. Through talks with the City of Atlanta Sustainability Office, such an urban agriculture classification is in development.

The needs for capital and water access are also common constraints, and expensive irrigation permits a significant barrier. For example, a gardener at Mattie Freeland stated, “We are in constant need of funds to just maintain, not even expand”. In regards to water access needs the gardener notes:

> We are using water from neighbors but now looking at rain barrels and long-term irrigation, but the cost is $1800 for just the irrigation permit only! We would like to see an exception of 5013c organizations for irrigation permits. I would think this would promote community investment. That can be huge hit to the budget”.

Transportation is an operational constraint for urban agriculture sites as well an access related barrier for community members. A farmer at Good Shepherd Urban Farm cites, “Transportation of materials like compost, tools, construction supplies, tools, equipment and food to market are challenging”.

A farmer at Atwood notes, “We realized during the first season of our farmer’s market that many of the residents that live near Atwood do not have transportation. So imagine walking a mile to the market is fine as long as you don’t have to carry a 2-5lb watermelon back home. Now add mobility or mental challenges to the equation, such as transitional housing,

seniors, families with small children, et cetera".

Another significant challenge is the lack of awareness of urban agriculture and community buy-in. A farmer at the Patchwork City Farms indicates, "It's disappointing that the community doesn't take advantage of the farm". Further, "We can't sell in neighborhood and the community isn't interested in joining a CSA" despite flexible payment options over time.

Local branding and marketing may serve to mitigate lack of awareness and promote local food system adoption; however, this also takes time away from production. Examples include expanded nutritional information, recipes, and cooking demonstrations. As evidenced from the produce shelf survey, all non-supermarket produce in the study lack pricing or labeling of any kind.

Socio-economic status may influence adoption of the local food system, and cultural or racial barriers may be present. A person involved with the Atwood Farm states a barrier or challenge to be, "Encouraging people to cook their own food again. There is a disconnect in how to prepare food, people don't recognize raw food which is a big challenge. There are racial and cultural barriers, racial in having left the farm and there are negative connotations with the countryside. Eating out is seen as middle class consumption; a higher status to be able to buy food".

A gardener at Mattie Freeland states:

> There is the indirect issue of a lack of interest in community work days. Two to twenty five folks may come out, but the neighborhood is increasingly of interest from outside the community- people find us on the web or from other churches. I'm very, very conscious of how events can look for neighbors and how it may be seen as white people coming in and taking over the garden. It may be viewed as someone else's space and

> someone else in control. The visual may be hard for some residents to see. I've heard remarks from residents about white people coming in again but they won't stay long because they're afraid to stay. I don't want people to not come and volunteer, but it can throw off the dynamics. I'm excited to see outsiders interested, but we need a balance between the neighbors and outsiders. There's a concern for motivations of strangers from outside the neighborhood. Residents are very cautious about motivations and gentrification. Investors are buying up houses by the dozens and we're unsure about where the situation is headed.

A gardener at Patchwork City Farms notes:

> Gardening and farming is perhaps either something unfamiliar or unknown to people in the neighborhood, so they may have no reason to become involved. I think a lot of people do not know the value of local food, do not believe they have the time for a hobby, or just have other interests. In higher income, well-educated communities, gardening is a popular trend, but not here.

To summarize, through strategic collaboration with community partners, the qualitative research and analysis from the local agriculture site interviews contributed significantly towards addressing the research questions relating the Fertile Crescent food system. Interviews revealed many insights into the history, operations, barriers and challenges of local agriculture sites. Given the abundant local food system production that exists in the study area, connections to the retail environmental and consumption are evaluated in the next section.

3.2 Produce Shelf Survey Results

The last component to the research methods involves quantitative analysis from the development and deployment of a mobile GIS-based shelf survey to evaluate the local availability of produce in the retail environment. To review, informed from the literature and through collaboration with community partners, the following research questions were developed, as shown in Table 3.2.1.

Table 3.2.1 Produce Shelf Survey Research Questions I

- Is local, sustainably grown produce available across the study area?
- Is produce advertised outside of the retail outlet? Women Infants and Children (WIC) program?
- What is the retail outlet type and number of registers?
- Is fresh produce available?
- How prominent is produce placement?
- What is the total vegetable, fruit, and herb variety?
- What is the ratio of local or organic?

To review, additional, finer grained research questions for the top three vegetable and fruit by shelf area were also developed, as shown in Table 3.2.2 below.

Table 3.2.2 Produce Shelf Survey Research Questions II

- What is the specific variety?
- Is the quality acceptable or is freshness questionable?
- Is the produce locally sourced? If so, what is the source? If not, what is the source?
- Is the produce labeled organic?
- What is the price?

This approach has the potential to mobilize residents and stakeholders towards bottom-up data collection towards strategic community research. A total of twenty-two retail outlets were surveyed from January through March 2013. The base ESRI business data contained four-teen retail outlets, where two were closed and one was unable to be located in the field. As a result, the rate of ESRI retail outlets to actual retail outlets on the ground was 55%. With 45%

of the total number of retail outlets unaccounted in these proprietary data, these discrepancies could have significant implications for planning and policy decisions. In addition to the coarse resolution of the ESRI data, the discrepancies in ESRI location data found through ground verification in the study area further reinforces the importance of primary data needs.

To address the first set of research questions, Table 3.2.3 shows retail outlet, store type, produce availability, total number of vegetable, fruit and herb variety, as well as whether the produce is labeled as organic or local. Ten of the twenty retail outlets- or 50%- stock produce of any kind. Just three stores stock vegetables of any variety, or 15%. Of the total number of vegetable, fruit, or herb variety, only 3% is labeled organic and 2% labeled as local. These findings suggest that the majority of available produce is grown within the conventional food system and imported into the Atlanta area for consumption.

Table 3.2.3 Retail Outlet Type and Total Produce Variety

Retail Outlet			Total Variety				
Name	Type	Produce	Veg	Fruit	Herb	Organic	Local
Albert Grocery	Convenience Store	No	NA	NA	NA	NA	NA
Assam food mart	Convenience Store	No	NA	NA	NA	NA	NA
Chevron	Gas Station	No	NA	NA	NA	NA	NA
Chevron	Gas Station	No	NA	NA	NA	NA	NA
Chevron Food Mart	Gas Station	Yes	0	1	0	0	0
Convenience Store	Convenience Store	No	NA	NA	NA	NA	NA
Exxon Food Mart	Gas Station	Yes	0	4	0	0	0
Fair Street Superette	Convenience Store	Yes	0	3	0	0	0
In town market	Convenience Store	No	NA	NA	NA	NA	NA
Johnny Store Grocery and Deli	Convenience Store	Yes	0	1	0	0	0
New Market	Convenience Store	No	NA	NA	NA	NA	NA
Northside Grocery	Convenience Store	Yes	0	2	0	0	0
Quick Stop Grocery	Convenience Store	Yes	2	2	0	0	0
S&S Food mart	Convenience Store	No	NA	NA	NA	NA	NA
Shell	Gas Station	No	NA	NA	NA	NA	NA

Retail Outlet			Total Variety				
Name	Type	Produce	Veg	Fruit	Herb	Organic	Local
Shopper's Market	Supermarket	Yes	17	8	0	0	0
Southern Grocer	Convenience Store	Yes	1	2	0	0	0
Texaco	Gas Station	Yes	0	1	0	0	0
Vine City Supermarket	Convenience Store	No	NA	NA	NA	NA	NA
Walmart	Supermarket	Yes	97	45	8	4	3
		Total	117	69	8	**4**	**3**
		Percent of Total	60	36	4	**3**	**2**

Informed from the literature and community partners, additional data regarding the retail outlets were collected. These include whether produce or the Women, Infants and Children (WIC) supplement program are advertised outside the retail outlet, number of registers, and how prominently produce is placed, as shown in table 3.2.4. Store type and produce availability is also shown for context. Neither produce availability nor the WIC program are advertised outside of the 10 retail outlets that stock produce. Seven of the ten stores place produce up front, though as the previous table illustrates, variety is low. The number of registers can serve as a proxy to store size where retail square footage is unavailable, which may be useful for planning purposes.

Table 3.2.4 Retail Outlet and Produce Characteristics

Retail Outlet				Produce		
Name	Type	WIC Advertised Outside	Number of Registers	Available	Placement	Advertised Outside
Albert Grocery	CS	No	2	No	NA	No
Assam food mart	CS	No	1	No	NA	No
Chevron	GS	No	2	No	NA	No
Chevron	GS	No	2	No	NA	No
Chevron Food Mart	GS	No	2	Yes	Front	No
Convenience Store	CS	No	1	No	NA	No
Exxon Food Mart	GS	No	2	Yes	Front	No
Fair Street Superette	CS	No	2	Yes	Front	No

Retail Outlet				Produce		
Name	Type	WIC Advertised Outside	Number of Registers	Available	Placement	Advertised Outside
In town market	CS	No	3	No	NA	No
Johnny Store Grocery and Deli	CS	No	2	Yes	Front	No
New Market	CS	No	1	No	NA	No
Northside Grocery	CS	No	2	Yes	Front	No
Quick Stop Grocery	CS	No	2	Yes	Back	No
S&S Food mart	CS	No	1	No	NA	No
Shell	GS	No	2	No	NA	No
Shopper's Market	S	No	2	Yes	Side	No
Southern Grocer	CS	No	2	Yes	Front	No
Texaco	GS	No	2	Yes	Front	No
Vine City supermarket	CS	No	2	No	NA	No
Walmart	S	No	13	Yes	Side	No

CS: Convenience Store, GS: Gas Station, S: Supermarket

In addition to general store and produce availability characteristics, finer grained data were collected to address research questions for the top three vegetable and fruit items by shelf area. These include the specific type of vegetable and fruit, quantity acceptable, quantity questionable in terms of freshness, sourcing of produce, and price. Table 3.2.5 shows these data for the top one vegetable by shelf area as an example. The additional top two and top three vegetable by shelf area is found in Appendix C. These data clearly illustrate the low variety and low quantity across eighteen of twenty retail outlets. In addition to capturing local or non-local attributes, the specific sourcing is also noted if available, which may serve to be useful for other planning purposes. Acceptable or questionable quality is included as well, and summarized in Figure 3.2.1 at the end of the section.

Table 3.2.5 Top 1 Vegetable by Shelf Area

Top 1 Vegetable by Shelf Area										
Retail Outlet				Quality			Origin			
Name	Type	Name	Qty	AQ	QQ	Local	Local Source	Non-Local Source	Org	Price
Albert Grocery	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Assam food mart	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chevron	GS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chevron	GS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chevron Food Mart	GS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Convenience Store	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Exxon Food Mart	GS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fair Street Superette	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
In town market	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Johnny Store Grocery and Deli	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
New Market	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Northside Grocery	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Quick Stop Grocery	CS	Lettuce	1-5	2	0	No	NA	Orlando	No	1.99/each
S&S Food mart	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Shell	GS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Shopper's Market	S	Lettuce	10+	29	0	No	NA	NA	No	.49/lb
Southern Grocer	CS	Onion	6-9	5	2	No	NA	NA	No	.39/each
Texaco	GS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vine City supermarket	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Walmart	S	Red potato	10+	402	8	No	NA	USA	No	2.77/ 5 lb

Type: CS: Convenience Store, GS: Gas Station, S: Supermarket
Quality: AQ = Acceptable Quality, QQ = Questionable Quality
Org: Organic

The top one fruit by shelf area is shown in Table 3.2.6. The additional top two and three fruit by shelf area is found in Appendix C. The top one fruit by shelf area include banana at seven retail outlets, orange at two outlets, and tomato at one outlet. Sourcing is labeled as Costa Rica (twice), Honduras, and Guatemala. Acceptable or questionable quality is included as well, and summarized in Figure 3.2.1 at the end of the section.

Table 3.2.6

Retail Outlet		Top 1 Fruit by Shelf Area								
				Quality						
Name	Type	Name	Qty	AQ	QQ	Org	Local	Local Source	Non-Local Source	Price
Albert Grocery	CS	NA	NA	NA	NA	NA	NA	NA	NA	
Assam food mart	CS	NA	NA	NA	NA	NA	NA	NA	NA	
Chevron	GS	NA	NA	NA	NA	NA	NA	NA	NA	
Chevron	GS	NA	NA	NA	NA	NA	NA	NA	NA	
Chevron Food Mart	GS	Banana	6-9	7	0	No	No		Costa Rica	2/ $1
Convenience Store	CS	NA	NA	NA	NA	NA	NA	NA	NA	
Exxon Food Mart	GS	Banana	10+	0	17	No	No		Costa Rica	.79/each
Fair Street Superette	CS	Banana	6-9	2	5	No	No			.50/each
In town market	CS	NA	NA	NA	NA	NA	NA	NA	NA	
Johnny Store Grocery and Deli	CS	Banana	1-5	2	0	No	No			$3 dollar
New Market	CS	NA	NA	NA	NA	NA	NA	NA	NA	
Northside Grocery	CS	Orange	6-9	7	0	No	No			.69 each
Quick Stop Grocery	CS	Tomato	1-5	5	0	No	No			.99 each
S&S Food mart	CS	NA	NA	NA	NA	NA	NA	NA	NA	
Shell	GS	NA	NA	NA	NA	NA	NA	NA	NA	
Shopper's Market	S	Banana	10+	104	0	No	No	NA	Honduras	.69/lb
Southern Grocer	CS	Orange	10+	10	0	No	No	NA	NA	.59/each
Texaco	GS	Banana	10+	20	12	No	No	NA	NA	.79 each
Vine City supermarket	CS	NA	NA	NA	NA	NA	NA	NA	NA	
Walmart	S	Banana	10+	3010	17	No	No	NA	Guatema-la	.55/lb

Type: CS: Convenience Store, GS: Gas Station, S: Supermarket
Quality: AQ = Acceptable Quality, QQ = Questionable Quality
Org: Organic

Figure 3.2.1 below shows the distribution and total produce variety by proportional symbol size across the study area by retail outlet type. The total top 1-3 vegetable and fruit by shelf area are represented, as well as percent acceptable quality based on visual inspection. Produce items were photographed directly with the ArcGIS mobile application and attached to each retail outlet point feature to serve as visual documentation for additional quality assessment.

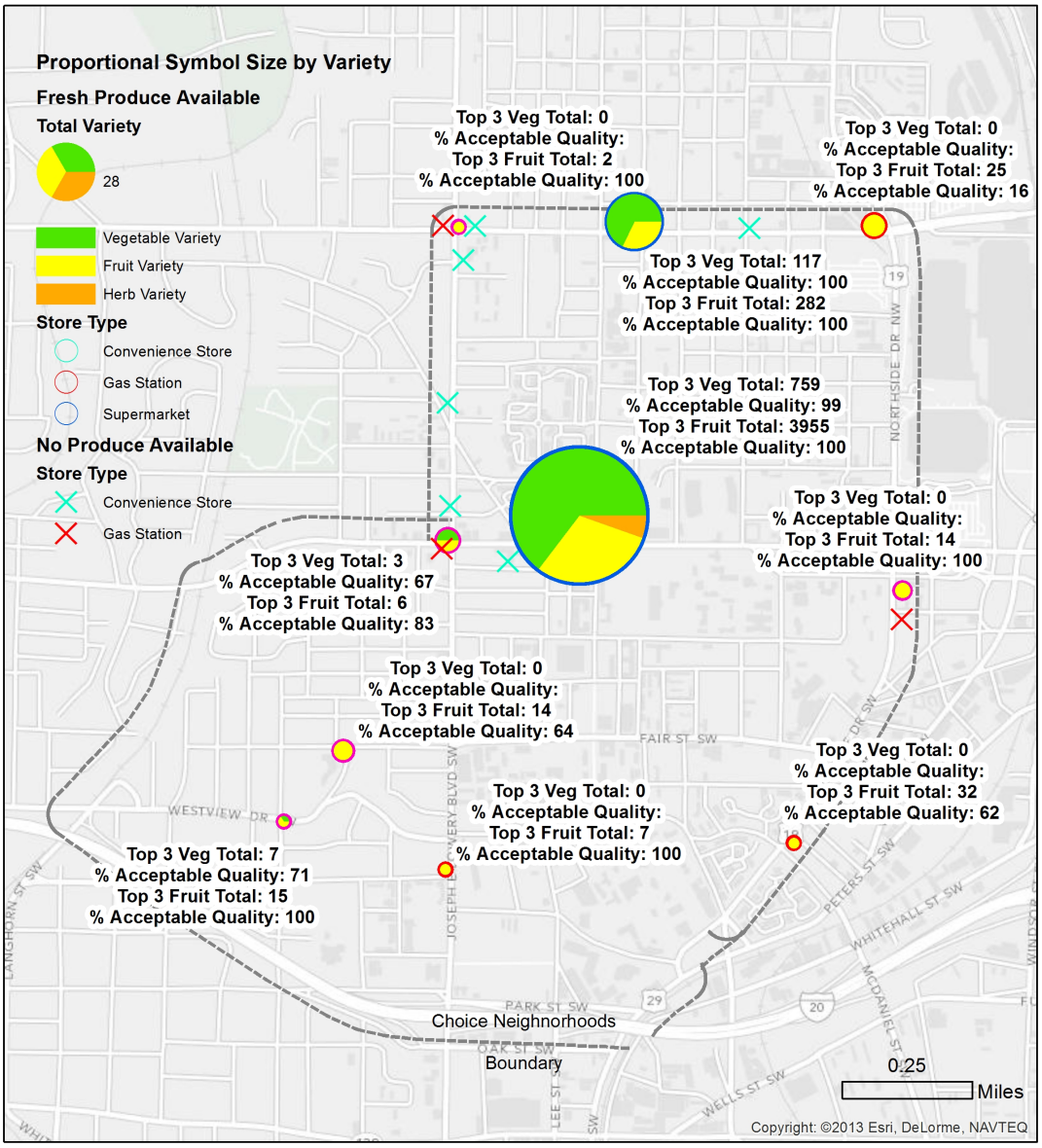

Figure 3.2.1 Map of Produce Total Variety, Total Top 3 number, Percent Acceptable Quality and Store Type. Map created by Ryan Barrett.

To summarize, these findings illustrate a lack of connections between the local production capacity and the retail environment of the study area. In addition, of the produce that is available, the distribution is poor, variety low, and in some cases of questionable quality. These results highlight significant opportunities to bridge connections between the local produce of the

Fertile Crescent food system and the retail environment. Discussion of the study is detailed in the next section.

3.3 Discussion

In this section, discussion of the primary findings of the study in relation to the literature is considered. There are four primary findings to be discussed. These findings include low access to local produce, benefits beyond food production, the application of GIS technology to the adapted paper-based survey, and field verified gaps in secondary data often relied upon for policy decisions.

The first finding relates to the lack of connections between the local food system and the retail environment of the study area. The results find just 2% of available produce variety is locally grown and just 3% organically grown. Reliable access to fresh locally sourced produce, grown with environmentally sound practices contributes significantly to the overall sustainability of communities. While access is critical for consumption, the responses highlight significant needs beyond access to better promote connections between the local food system and the retail environment. There is an overall need to increase awareness of the local food system to reconnect relationships between people and local fresh food. Strategies to increase awareness include, marketing, enhanced labeling with informational and promotional materials to inform of nutritional benefits, recipes, cooking classes, and increased educational and training opportunities. While these efforts take time away for agriculture management, organizations like the Atlanta Metro Food & Farm Network (AM-FFN), the Atlanta Local Food Initiative, Georgia Organics and others are actively engaged in addressing some of these issues. The local food sys-

tem could benefit from an overarching framework such as the AM-FFN promoted Food Commons, modeled after an initiative in Fresno, California. The Food Commons is in development in the Fertile Crescent and is comprised of three components: a food trust, food fund, and food hub. The literature has a strong focus relating to access, though more research is needed to extend the research beyond access towards inhibitors to adoption of local food systems.

The benefits beyond food production and access are the second primary finding. A surprising result from the agriculture site interviews revealed the vast majority of recognized benefits to be other than food access and healthy food production. Of the 85 total benefits of urban agriculture to the community, food production and access accounted for 13% of benefits, where other benefits accounted for 87%. More specifically, the highest ranking benefit to urban agriculture from interview responses is social, at 41%. The next highest ranked benefit is environmental and social at 15%. Educational and environmental is the third highest ranked benefit at 13%. While many of the benefits beyond food production of local food systems are beginning to be recognized (Beilin & Hunter 2011; Macias 2008), more research is needed as these results clearly show.

The third primary finding relates to the expansion of literature of the study. Through collaboration with community partners, the literature is enhanced by expanding the paper-based NEMS survey and by the development and application of a mobile GIS-based framework to evaluate local produce availability in the retail environment. In applying ESRI ArcGIS Server and Spatial Database Engine (SDE) technology, many benefits are realized over a paper-based method. Benefits include enhanced quality control in an enterprise environment for geographic data collection and an accessible framework for residents and community stakeholders to lev-

erage. In using an enterprise SDE environment, data are synced across all devices in real time. With data in sync, the mobile-GIS based survey can be deployed by multiple devises to streamline direct digital data collection. In addition to collecting geographic features and attributes in real time, this framework also allows for feature-linked photographic documentation. Lastly, this GIS-based framework can easily be leveraged by residents in the community and stakeholders towards strategic research and data needs. For example, a text message link can be sent to deploy the tool on an Apple iOS, Android, or Windows device.

Field verified gaps in secondary data often relied upon for policy decisions is the last primary finding**.** In comparison to ESRI business location data - which served as a base to locate food retail businesses in the field - considerable discrepancies were identified. Through canvasing of streets in the study area, a total of 20 food retail outlets were surveyed. In the same area, the ESRI business data included just fourteen retail food outlets, where two were closed and one was unable to be located in the field. As a result, the rate of ESRI retail outlets to actual food retail outlets was just 55%. In considering that 45% of the total number of locations were not available in these proprietary data, these discrepancies could have significant implications. As these data are often relied upon for planning and policy making, decisions may be inadvertently influenced if data are missing or incomplete.

These results show that data collected through this study are more comprehensive where secondary data are missing or out of date, further reinforcing the importance of primary data needs. Additionally, these findings highlight an opportunity to leverage the ESRI ArcGIS mobile platform for primary data collection to better inform planning and policy decisions.

Lastly, this study suggests that more critique is needed regarding secondary data sources such as ESRI business data. The conclusion of the study is discussed in the next section.

4 CONCLUSION

This mixed methods study examined the local food system in the Fertile Crescent in Southwest Atlanta, Georgia. Available secondary data may be of a scale and granularity that is insufficient to meet research and planning needs of the community, or may exclude data altogether as the produce shelf survey base location data revealed. Given secondary data limitations, partnerships were formed to collaboratively develop primary data and research needs.

Interview questions were strategically developed with community partners for site visits to gain further insight into the history, operation, barriers and challenges to the local Fertile Crescent Food System. Results from the qualitative methods research reveal local agriculture sites widely recognize interrelated benefits and adopt practices that align more closely to the sustainability of the community compared to the dominant conventional food system. However, interviews reveal many barriers and challenges that must be addressed for closer alignment with overall sustainability of the communities. Impediments and challenges to the local food system include resource constraints, lack of community buy-in and awareness, as well as socio economic, cultural and racial barriers.

A GIS-based mobile tool was developed to evaluate produce availability in the retail environment and examine connections to the substantial local production in the local food system. The mobile framework can serve as a platform for bottom up community engagement to leverage towards primary data collection and strategic research through community based,

participatory GIS. Results from the quantitative methods research reveal a lack of connectivity between the local capacities of the Fertile Crescent food system. Of the total number of vegetable, fruit, or herb variety, only 3% is labeled organic and 2% labeled as locally sourced. Where conventionally grown produce is available, variety is low and distribution poor outside of the two supermarkets in the study area.

By utilizing mixed methods through a collaborative framework, planning and policy considerations may better facilitate connections between local agriculture sites and retail opportunities. This effort may serve to stimulate local economic growth, strengthen sustainability and promote positive health outcomes in neighborhood communities.

Lastly, this research model may be scaled across geographies and through the seasons to contribute further to local food system planning and policy decisions in the Atlanta area an beyond.

4.1 Limitations and Challenges

There are several limitations to this study. Limitations include the subjectivity of the produce quality evaluation in data collection, time frame of the GIS-based produce shelf survey and minor technical challenges. In recognizing these limitations and challenges, future research may be more informed.

An attribute of the NEMS survey – and included in the adapted GIS-based mobile tool- is quality, where acceptable or questionable is recorded. Quality can be a contentious measure, though predominant classification in the literature regarding produce evaluation seems to agree with either an acceptable or unacceptable attribute being sufficient (Block & Kouba 2006;

Glanz et al. 2007; Cavanaugh et al. 2013; Kelly et al. 2006). Future work towards a more refined classification may serve to enhance quality of produce evaluation.

The time frame of the GIS-based produce shelf survey may also be a limitation of this study. Although produce is grown throughout all seasons in the Atlanta climate, the survey being conducted from January through April 2013 may not represent availability across time in the retail environment. For example, produce stocking may be seasonal and not available during the time frame of this study, but may be available at other times. In order to address this limitation, this GIS-based mobile framework could be leveraged by residents and community stakeholders for additional surveys throughout the seasons and across geographies to more comprehensively evaluate local produce availability and connections to local production.

Lastly, minor technical challenges were experienced in the study. Although of negligible impact to the research, these challenges should be addressed in future studies. Spatial Database Engine date and time stamps failed to function as expected and require further troubleshooting to deploy. In addition, feature linked photographic documentation failed to save in one instance when using the ArcGIS Mobile application, potentially due to a poor data connection. In future workflow, on site confirmations of saved feature linked photographs is encouraged. Given the limited technical challenges through the extensive use of the ArcGIS mobile and server platform for field collection, this environment is well suited for future collection efforts.

4.2 Future Research Implications

The methodology and results of this collaborative research model and GIS-based produce evaluation tool may have many implications to future research in the Atlanta area as well

other geographies. Implications include better informed planning and policy decisions related to the local food system and an open framework for residents and community stakeholders to leverage towards strategic research needs.

In working with community partners, this collaborative research model provides results to directly benefit planning and policy decisions in Atlanta area. In addition, this model can serve to inform related studies and be scaled across Atlanta to other geographies. The GIS-based produce evaluation framework can be easily deployed across Atlanta and geographies beyond. In addition, data can be collected over time for historical comparison. The data model and GIS feature service is hosted by the Georgia State University Geosciences Laboratory and available for future research applications, and can be used as a collaborative research approach to better inform planning and policy decisions in Atlanta, Georgia.

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APPENDICES

Appendix A

Appendix A.1 Produce Shelf Survey Data Model, adapted from Glanz et al. (2007) and Cavanaugh et al. (2013)

FIELD ALIAS	ATTRIBUTE	DOMAIN	TYPE	LENGTH	GEODATABASE FIELD NAME
Created By	Automatically populated	NA	Text	20	CREATEDBY
Date Created	Automatically populated	NA	Date	10	DATECREATED
Last Edit By	Automatically populated	NA	Text	20	LASTEDITBY
Last Edit Date	Automatically populated	NA	Date	10	LASTEDITDATE
Store Name	[Text Input]	NA	Text	100	STORE_NAME
Store Type	Convenience Store	StoreType	Text	30	STORE_TYPE
	Gas Station				
	Other Grocery <2500sqft				
	Supermarket				
	Other - note in comments				
WIC Advertised Outside	Yes	YesNo	Text	3	WIC_ADVERT_OUTSIDE
	No				
Fresh Produce Advertised Outside	Yes	YesNo	Text	3	FRESH_PROD_ADVERT_OUTSIDE
	No				
Number of Registers	[Number Input]	NA	Integer	Short	NUMBER_REGISTERS
Produce Availability	Yes	YesNo	Text	3	FRESH_PRODUCE
	No				
Produce Placement	Front	Placement	Text	6	PLACEMENT
	Middle				
	Back				
	Other - note in comments				
Vegetable Variety Total Number	[Number Input]	NA	Integer	Short	VEGETABLE_VARIETY
Fruit Variety Total Number	[Number Input]	NA	Integer	Short	FRUIT_VARIETY
Herb Variety Total Number	[Number Input]	NA	Integer	Short	HERB_VARIETY
Local Variety Total Number	[Number Input]	NA	Integer	Short	LOCAL_VARIETY
Organic Variety Total Number	[Number Input]	NA	Integer	Short	ORGANIC_VARIETY

Appendix A.2 Produce Shelf Survey Data Model Top 1 Vegetable by Shelf Area

FIELD ALIAS	ATTRIBUTE	DOMAIN	TYPE	LENGTH	GEODATABASE FIELD NAME
Top 1 Vegetable	[Text Input]	NA	Text	50	TOP_1_VEG
Top 1 Veg Qty	1 to 5	Qty	Text	5	TOP_1_VEG_QTY
	6 to 9				
	10 +				
Top 1 Veg Quality acceptable	[Number Input]	NA	Integer	Short	TOP_1_VEG_ACCEPTABLE
Top 1 Veg Quality unacceptable	[Number Input]	NA	Integer	Short	TOP_1_VEG_UNACCEPTABLE
Top 1 Veg Organ-ically Grown	Yes	YesNo	Text	3	TOP_1_VEG_NATURAL
	No				
Top 1 Veg Locally Sourced	Yes	YesNo	Text	3	TOP_1_VEG_LOCAL
	No				
Top 1 Veg Local Source	[Text Input]	NA	Text	50	TOP_1_VEG_LOCAL_SOURCE
Top 1 Veg Non-Local Source	[Text Input]	NA	Text	50	TOP_1_VEG_NONLOCAL_SOURCE
Top 1 Veg Price	[$/lb or qty input]	NA	Text	50	TOP_1_VEG_PRICE

Appendix A.3 Produce Shelf Survey Data Model Top 2 Vegetable by Shelf Area

FIELD ALIAS	ATTRIBUTE	DOMAIN	TYPE	LENGTH	GEODATABASE FIELD NAME
Top 2 Vegetable	[Text Input]	NA	Text	50	TOP_2_VEG
Top 2 Veg Qty	1 to 5	Qty	Text	5	TOP_2_VEG_QTY
	6 to 9				
	10 +				
Top 2 Veg Quality acceptable	[Number Input]	NA	Integer	Short	TOP_2_VEG_ACCEPTABLE
Top 2 Veg Quality unacceptable	[Number Input]	NA	Integer	Short	TOP_2_VEG_UNACCEPTABLE
Top 2 Veg Organ-ically Grown	Yes	YesNo	Text	3	TOP_2_VEG_NATURAL
	No				
Top 2 Veg Locally Sourced	Yes	YesNo	Text	3	TOP_2_VEG_LOCAL
	No				
Top 2 Veg Local Source	[Text Input]	NA	Text	50	TOP_2_VEG_LOCAL_SOURCE
Top 2 Veg Non-Local Source	[Text Input]	NA	Text	50	TOP_2_VEG_NONLOCAL_SOURCE
Top 2 Veg Price	[$/lb or qty input]	NA	Text	50	TOP_2_VEG_PRICE

Appendix A.4 Produce Shelf Survey Data Model Top 3 Vegetable by Shelf Area

FIELD ALIAS	ATTRIBUTE	DOMAIN	TYPE	LENGTH	GEODATABASE FIELD NAME
Top 3 Vegetable	[Text Input]	NA	Text	50	TOP_3_VEG
Top 3 Veg Qty	1 to 5	Qty	Text	5	TOP_3_VEG_QTY
	6 to 9				
	10 +				
Top 3 Veg Quality acceptable	[Number Input]	NA	Integer	Short	TOP_3_VEG_ACCEPTABLE
Top 3 Veg Quality unacceptable	[Number Input]	NA	Integer	Short	TOP_3_VEG_UNACCEPTABLE
Top 3 Veg Organically Grown	Yes	YesNo	Text	3	TOP_3_VEG_NATURAL
	No				
Top 3 Veg Locally Sourced	Yes	YesNo	Text	3	TOP_3_VEG_LOCAL
	No				
Top 3 Veg Local Source	[Text Input]	NA	Text	50	TOP_3_VEG_LOCAL_SOURCE
Top 3 Veg Non-Local Source	[Text Input]	NA	Text	50	TOP_3_VEG_NONLOCAL_SOURCE
Top 3 Veg Price	[$/lb or qty input]	NA	Text	50	TOP_3_VEG_PRICE

Appendix A.5 Produce Shelf Survey Data Model Top 1 Fruit by Shelf Area

FIELD ALIAS	ATTRIBUTE	DOMAIN	TYPE	LENGTH	GEODATABASE FIELD NAME
Top 1 Fruit	[Text Input]	NA	Text	50	TOP_1_FRUIT
Top 1 Fruit Qty	1 to 5	Qty	Text	5	TOP_1_FRUIT_QTY
	6 to 9				
	10 +				
Top 1 Fruit Quality acceptable	[Number Input]	NA	Integer	Short	TOP_1_FRUIT_ACCEPTABLE
Top 1 Fruit Quality unacceptable	[Number Input]	NA	Integer	Short	TOP_1_FRUIT_UNACCEPTABLE
Top 1 Fruit Organically Grown	Yes	YesNo	Text	3	TOP_1_FRUIT_NATURAL
	No				
Top 1 Fruit Locally Sourced	Yes	YesNo	Text	3	TOP_1_FRUIT_LOCAL
	No				
Top 1 Fruit Local Source	[Text Input]	NA	Text	50	TOP_1_FRUIT_LOCAL_SOURCE
Top 1 Fruit Non-Local Source	[Text Input]	NA	Text	50	TOP_1_FRUIT_NONLOCAL_SOURCE
Top 1 Fruit Price	[$/lb or qty input]	NA	Text	50	TOP_1_FRUIT_PRICE

Appendix A.6 Produce Shelf Survey Data Model Top 2 Fruit by Shelf Area

FIELD ALIAS	ATTRIBUTE	DOMAIN	TYPE	LENGTH	GEODATABASE FIELD NAME
Top 2 Fruit	[Text Input]	NA	Text	50	TOP_2_FRUIT
Top 2 Fruit Qty	1 to 5	Qty	Text	5	TOP_2_FRUIT_QTY
	6 to 9				
	10 +				
Top 2 Fruit Quality acceptable	[Number Input]	NA	Integer	Short	TOP_2_FRUIT_ACCEPTABLE
Top 2 Fruit Quality unacceptable	[Number Input]	NA	Integer	Short	TOP_2_FRUIT_UNACCEPTABLE
Top 2 Fruit Organically Grown	Yes	YesNo	Text	3	TOP_2_FRUIT_NATURAL
	No				
Top 2 Fruit Locally Sourced	Yes	YesNo	Text	3	TOP_2_FRUIT_LOCAL
	No				
Top 2 Fruit Local Source	[Text Input]	NA	Text	50	TOP_2_FRUIT_LOCAL_SOURCE
Top 2 Fruit Non-Local Source	[Text Input]	NA	Text	50	TOP_2_FRUIT_NONLOCAL_SOURCE
Top 2 Fruit Price	[$/lb or qty input]	NA	Text	50	TOP_2_FRUIT_PRICE

Appendix A.7 Produce Shelf Survey Data Model Top 3 Fruit by Shelf Area

FIELD ALIAS	ATTRIBUTE	DOMAIN	TYPE	LENGTH	GEODATABASE FIELD NAME
Top 3 Fruit	[Text Input]	NA	Text	50	TOP_3_FRUIT
Top 3 Fruit Qty	1 to 5	Qty	Text	5	TOP_3_FRUIT_QTY
	6 to 9				
	10 +				
Top 3 Fruit Quality acceptable	[Number Input]	NA	Integer	Short	TOP_3_FRUIT_ACCEPTABLE
Top 3 Fruit Quality unacceptable	[Number Input]	NA	Integer	Short	TOP_3_FRUIT_UNACCEPTABLE
Top 3 Fruit Organically Grown	Yes	YesNo	Text	3	TOP_3_FRUIT_NATURAL
	No				
Top 3 Fruit Locally Sourced	Yes	YesNo	Text	3	TOP_3_FRUIT_LOCAL
	No				
Top 3 Fruit Local Source	[Text Input]	NA	Text	50	TOP_3_FRUIT_LOCAL_SOURCE
Top 3 Fruit Non-Local Source	[Text Input]	NA	Text	50	TOP_3_FRUIT_NONLOCAL_SOURCE
Top 3 Fruit Price	[$/lb or qty input]	NA	Text	50	TOP_3_FRUIT_PRICE
Comments	[Text Input]	NA	Text	250	COMMENTS

Appendix A.8 Produce Shelf Survey Data Model Domains

Domain	Value	Domain	Value
StoreType	Convenience Store	**Qty**	1 to 5
	Gas Station		6 to 9
	Other Grocery <2500sqft		10 +
	Supermarket	**Placement**	Front
	Other - note in comments		Middle
YesNo	Yes		Back
	No		Other

Appendix B

Appendix B.1 Origin of Urban Agriculture Site, Funding and Maintenance

Garden/ Farm	Origin	Funding/ Maintenance
Atwood	2010 proposed idea to land owners	Funded through grants, donations
	A. Grassroots	Maintained through volunteer labor
	B. Leased	
	C. Mixed beds to showcase possibilities	
Mattie Freeland	2008 by Church members and neighbors	Funded by Church
	A. Mixed: External Church members and Internal Neighbors	Maintained through volunteer workdays
	B. Owned by Church	
	C. Raised beds	
Good Shepherd	2008	Funded by Church
	A. Grassroots	Tools and training exchanged for labor
	B. Owned by Church	
	C. Mixed beds	
Rose Circle	2009,by community members	Resourceful to get reclaimed materials
	A. Grassroots	Nominal contributions for water
	B. Owned by community member	Volunteer labor
	C. Mixed	Community member labor
Ashview Community Garden	2010, by community members	Some grant funding
	A. Grassroots	Volunteer labor
	B. Leased	
	C. Ground	
Samuel Williamson Community Garden	2010, by community members	Community funded
	A. Grassroots	Community member labor
	B. Owned, arrangement to use	
	C. Ground	
Patchwork City Farms	2008, by community members	Farmer funded, grants
	A. Grassroots	Volunteer labor
	B. Leased	Community member labor
	C. Mixed	

Appendix B.2 Seed Sourcing and Soil Nutrient Replenishment

Garden/ Farm	Seed Sourcing	Soil Nutrient Replenishment
Atwood	Seeds through Atlanta Community Food Bank	Compost, mulch, newspaper, organic soil conditioners
	Starters through Oakhurst Community Gardens	On site composting
Mattie Freeland	Primarily starters from Home Depot, some seeds	Compost from DeKalb County
	Seedling donations	Compost from Home Depot
		Organic fertilizer
Good Shepherd	Heirloom seeds	Through relationships with community
	Metro Atlanta Urban Farm	Compost dropped off by community members
	Seeds saved	On site composting
		Marigolds to deter pests
Rose Circle	Donations from seed company	Rabbit manure from companion
	Buy organic	Compost from mulch from community
	Seed swap	On site composting
	Reap, save seeds	
Ashview Community Garden	Purchase organic heirloom	College Park composting
		Other amendments as needed
Samuel Williamson Community Garden	Home Depot	Compost from City of Atlanta
		Home Depot
Patchwork City Farms	Certified Naturally Grown from national organic seed companies	Cover crops
	Seed saving companies	Organic fertilizer manure for goats and chickens
		Horse manure
		Other local sources
		Organic soil from local company
		On site composting

Appendix B.3 Pest/Weed/Disease Control, Crop Management and Land Area

Garden/ Farm	Pest/Weed/Disease Control	Crop Management	Land area used
Atwood	Promote healthy sold	Crop rotation	3.5 acres for education center
	Manual weed pulling	Companion planting/ Intercropping	1.5 acres for production
Mattie Freeland	Research and diagnose	Some crop rotation	< .25 acre
	Organic pesticides		
Good Shepherd	Let the weeds grow but pull before flower and compost	Crop rotation	5 total acres
	Diseases controlled by developing compost and soil fertility	Companion planting/ Intercropping	.75 acres for production
Rose Circle	Bacillus thuringiensis natural pesticide	Crop rotation	.25 acres
		Intercropping	
Ashview Community Garden	Trap crops to attract unwanted bugs	Crop rotation	.5 acres
	Natural pesticides such as garlic, cayenne, peppermint oil	Resistant varieties	
		Intercropping	
Samuel Williamson Community Garden	Hand weeding	None	< .25 acre
Patchwork City Farms	Manual weeding	Companion planting/ Intercropping	1 acre farm
	Heavy mulching		.5 for production

Appendix B.4 Sales Method, Distribution, and Access

Garden/ Farm	Sales Method	Distribution Channel of Food	Access
Atwood	Weekly Farmers Market	Visitors to market	Gated, by request outside market/event hours
		Volunteers after shift	
		Chef Growers to sell or prepare meals	
Mattie Freeland	NA	Anyone interested in neighborhood	Open, walk up.
Good Shepherd	Selling through Metro Atlanta Urban Farms to local markets, urban farms	Beyond restaurants, inside community	Open, walk up
	CSA	Volunteers after shift	
Rose Circle	NA	Most within community, some outside	Open, walk up/ contact online
Ashview Community Garden	Local farmers market	Local market	Open, walk up
		Volunteers after shift	
		Neighborhood donations on needs basis	
Samuel Williamson Community Garden	No, local stores approached but not interested in carrying	Within community	Open to volunteers
Patchwork City Farms	Primarily farmers markets outside neighborhood	Primarily Farmers markets outside neighborhood	Fenced, open to everyone, walk up or arrange visit
	Vegetable truck that sells to restaurants	Small farmers market within Neighborhood	No access during school hours
	Little community interest in CSA, most members outside community	Little interest in CSA, most members outside community	
	Sell to some chefs directly	Volunteers after shift	

Appendix B.5 Contributions Beyond Volunteering

Garden/ Farm	Beyond Volunteering
Atwood	Cash donations
	Youth group STEM field trips at $7
	Host garden party at $8
	Book special event at $30-50/ hour
	Help raise awareness
	Funding
Mattie Freeland	Funding
Good Shepherd	Learn about mission of land, education, and feeding community
	Financial resources
	Help raise awareness
	Visiting to enjoy and get fresh food helps define space for nourishment
	Donating compost
	Donating tools
	Donate materials
Rose Circle	Donating supplies
	Donating seeds
	Donation equipment
	Educational programming
	Vehicle to transport materials
	Donating wood chips and compost
Ashview Community Garden	Monetary donations
	Tool donations
	Food donations for volunteers days
	Educators, especially for youth
	Donate time as instructor, promote garden
Samuel Williamson Community Garden	Funding
	Donating tools
	Donating supplies
Patchwork City Farms	Funding
	Donate equipment
	Donate materials
	Ownership of land
	Could expand with more funding to cooking classes and educational program-ming
	Can purchase from markets
	Make a contribution to Wholesome Waves Georgia
	Donation of supplies

Appendix B.6 Varieties of Food Grown

Varieties of Food Grown	Count	Varieties (cont.)	Count
Tomatoes	5	Fennel	1
Squash	3	Field Peas	1
Onions	3	Fig	1
Eggplant	3	Flowers	1
Cucumbers	3	Fruit bushes and trees	1
Various vegetables	2	Garlic	1
Strawberries	2	Greens	1
Peppers	2	Hibiscus	1
Okra	2	Holy basil	1
Mustard greens	2	Horseradish	1
Leeks	2	Lemon Balm	1
Kale	2	Lettuce	1
Herbs	2	Marigolds	1
Green beans	2	Marjoram	1
Collards	2	Onions	1
Carrots	2	Oregano	1
Arugula	2	Plums	1
Acorn Squash	1	Pole beans	1
Based on interests of neighborhood surveys	1	Potatoes	1
Basil Varieties	1	Pumpkins	1
Bean varieties	1	Root vegetables	1
Beans	1	Running survey/ poll to gauge interest	1
Blueberries	1	Salad greens	1
Bok Choy	1	Sorghum	1
Cabbages	1	Sunflowers	1
Cherry tomato	1	Sweet Potato	1
Cilantro	1	Thyme	1
Crabapple	1	Turnip Greens	1
Daikon Radish	1	Various fruits	1
Dill	1	Yellow Squash	1
Fava beans	1		

Appendix C

Appendix C.1 Top 1 Vegetable by Shelf Area Data

Retail Outlet		Top 1 Vegetable by Shelf Area								
				Quality			Origin			
Name	Type	Name	Qty	AQ	QQ	Local	Local Source	Non-Local Source	Org	Price
Albert Grocery	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Assam food mart	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chevron	GS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chevron	GS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chevron Food Mart	GS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Convenience Store	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Exxon Food Mart	GS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fair Street Superette	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
In town market	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Johnny Store Grocery and Deli	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
New Market	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Northside Grocery	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Quick Stop Grocery	CS	Lettuce	1-5	2	0	No	NA	Orlando	No	1.99/each
S&S Food mart	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Shell	GS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Shopper's Market	S	Lettuce	10+	29	0	No	NA	NA	No	.49/lb
Southern Grocer	CS	Onion	6-9	5	2	No	NA	NA	No	.39/each
Texaco	GS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vine City supermarket	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Walmart	S	Red potato	10+	402	8	No	NA	USA	No	2.77/ 5 lb

Type: CS: Convenience Store, GS: Gas Station, S: Supermarket
Quality: AQ = Acceptable Quality, QQ = Questionable Quality
Org: Organic

Appendix C.1 Top 2 Vegetable by Shelf Area Data

Retail Outlet		Top 2 Vegetable by Shelf Area								
				Quality		Origin				
Name	Type	Name	Qty	AQ	QQ	Local	Local Source	Non-Local Source	Org	Price
Albert Grocery	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Assam food mart	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chevron	GS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chevron	GS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chevron Food Mart	GS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Convenience Store	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Exxon Food Mart	GS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fair Street Superette	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
In town market	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Johnny Store Grocery and Deli	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
New Market	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Northside Grocery	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Quick Stop Grocery	CS	Green bell pepper	1-5	NA	1	No	NA	NA	No	.99/each
S&S Food mart	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Shell	GS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Shopper's Market	S	Onion	10+	81	0	No	NA	Michigan	No	1.99/ bag
Southern Grocer	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Texaco	GS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vine City supermarket	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Walmart	S	Onion	10+	306	0	No	NA	Idaho, Indiana	No	2.18/ bag

Type: CS: Convenience Store, GS: Gas Station, S: Supermarket

Quality: AQ = Acceptable Quality, QQ = Questionable Quality

Org: Organic

Appendix C.2 Top 3 Vegetable by Shelf Area Data

Retail Outlet		Top 3 Vegetable by Shelf Area								
				Quality			Origin			
Name	Type	Name	Qty	AQ	QQ	Local	Local Source	Non-Local Source	Org	Price
Albert Grocery	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Assam food mart	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chevron	GS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chevron	GS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chevron Food Mart	GS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Convenience Store	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Exxon Food Mart	GS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Fair Street Super-ette	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
In town market	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Johnny Store Gro-cery and Deli	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
New Market	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Northside Grocery	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Quick Stop Grocery	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
S&S Food mart	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Shell	GS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Shopper's Market	S	Collard greens	6-9	7	0	No	NA	NA	No	1.49/each
Southern Grocer	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Texaco	GS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vine City super-market	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Walmart	S	Broccoli	10+	42	1	No	NA	Oviedo, Florida	No	2.58/bunch

Type: CS: Convenience Store, GS: Gas Station, S: Supermarket

Quality: AQ = Acceptable Quality, QQ = Questionable Quality

Org: Organic

Appendix C.4 Top 1 Fruit by Shelf Area Data

Retail Outlet		Top 1 Fruit by Shelf Area								
				Quality						
Name	Type	Name	Qty	AQ	QQ	Org	Local	Local Source	Non-Local Source	Price
Albert Grocery	CS	NA	NA	NA	NA	NA	NA	NA	NA	
Assam food mart	CS	NA	NA	NA	NA	NA	NA	NA	NA	
Chevron	GS	NA	NA	NA	NA	NA	NA	NA	NA	
Chevron	GS	NA	NA	NA	NA	NA	NA	NA	NA	
Chevron Food Mart	GS	Banana	6-9	7	0	No	No		Costa Rica	2/ $1
Convenience Store	CS	NA	NA	NA	NA	NA	NA	NA	NA	
Exxon Food Mart	GS	Banana	10+	0	17	No	No		Costa Rica	.79/each
Fair Street Superette	CS	Banana	6-9	2	5	No	No			.50/each
In town market	CS	NA	NA	NA	NA	NA	NA	NA	NA	
Johnny Store Grocery and Deli	CS	Banana	1-5	2	0	No	No			$3 dollar
New Market	CS	NA	NA	NA	NA	NA	NA	NA	NA	
Northside Grocery	CS	Orange	6-9	7	0	No	No			.69 each
Quick Stop Grocery	CS	Tomato	1-5	5	0	No	No			.99 each
S&S Food mart	CS	NA	NA	NA	NA	NA	NA	NA	NA	
Shell	GS	NA	NA	NA	NA	NA	NA	NA	NA	
Shopper's Market	S	Banana	10+	104	0	No	No	NA	Honduras	.69/lb
Southern Grocer	CS	Orange	10+	10	0	No	No	NA	NA	.59/each
Texaco	GS	Banana	10+	20	12	No	No	NA	NA	.79 each
Vine City supermarket	CS	NA	NA	NA	NA	NA	NA	NA	NA	
Walmart	S	Banana	10+	3010	17	No	No	NA	Guatema-la	.55/lb

Type: CS: Convenience Store, GS: Gas Station, S: Supermarket
Quality: AQ = Acceptable Quality, QQ = Questionable Quality
Org: Organic

Appendix C.4 Top 2 Fruit by Shelf Area Data

Retail Outlet		Top 2 Fruit by Shelf Area								
		Quality						Origin		
Name	Type	Name	Qty	AQ	QQ	Org	Local	Local Source	Non-Local Source	Price
Albert Grocery	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Assam food mart	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chevron	GS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chevron	GS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chevron Food Mart	GS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Convenience Store	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Exxon Food Mart	GS	Apple	1-5	1	3	No	No	NA	USA	.79/each
Fair Street Superette	CS	Apple	1-5	4	0	No	No	NA	NA	.50/each
In town market	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Johnny Store Grocery and Deli	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
New Market	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Northside Grocery	CS	Banana	6-9	7	0	No	No	NA	NA	.69/each
Quick Stop Grocery	CS	Lime	1-5	0	1	No	No	NA	Mexico	.99/each
S&S Food mart	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Shell	GS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Shopper's Market	S	Tomato	10+	52	0	No	No			.89/each
Southern Grocer	CS	Banana	1-5	5	0	No	No	NA	NA	2/ $1
Texaco	GS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vine City supermarket	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Walmart	S	Orange	10+	760	0	No	No	NA	Terra Bella, California	3.50/bag

Type: CS: Convenience Store, GS: Gas Station, S: Supermarket
Quality: AQ = Acceptable Quality, QQ = Questionable Quality
Org: Organic

Appendix C.5 Top 3 Fruit by Shelf Area Data

Retail Outlet		Top 3 Fruit by Shelf Area		Quality			Origin			
Name	Type	Name	Qty	AQ	QQ	Org	Local	Local Source	Non-Local Source	Price
Albert Grocery	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Assam food mart	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chevron	GS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chevron	GS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chevron Food Mart	GS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Convenience Store	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Exxon Food Mart	GS	Orange	1-5	3	1	No	No	NA	Florida	.79/each
Fair Street Super-ette	CS	Orange	1-5	3	0	No	No	NA	NA	.69/each
In town market	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Johnny Store Gro-cery and Deli	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
New Market	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Northside Grocery	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Quick Stop Grocery	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
S&S Food mart	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Shell	GS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Shopper's Market	S	Orange	10+	126	0	No	No	NA	Florida	1.19/each
Southern Grocer	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Texaco	GS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vine City super-market	CS	NA	NA	NA	NA	NA	NA	NA	NA	NA
Walmart	S	Strawberries	10+	168	0	No	No	NA	Plant city Florida	1.75/lb

Type: CS: Convenience Store, GS: Gas Station, S: Supermarket

Quality: AQ = Acceptable Quality, QQ = Questionable Quality

Org: Organic